

NOTES AND COMMENTS



High and rapid infestation of isolated commercial honey bee colonies with small hive beetles in Australia

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Small hive beetles (SHB), *Aethina tumida*, are parasites and scavengers of honey bee, *Apis mellifera*, colonies native to sub-Saharan Africa (Neumann and Elzen, 2004). They became an invasive species and were first detected in NSW, Australia in 2001 (Gillespie *et al.*, 2003; Neumann and Ellis, 2008). Eradication of SHB appeared impossible, because SHB infestations were found in several feral colonies (Gillespie *et al.*, 2003; Annand, 2007). Since then, SHB have now become well established in Australia (Neumann and Ellis, 2008) and can cause considerable damage to local apiculture. In order to clarify whether SHB may use feral colonies as a refuge from which to infest apiaries, we investigated the natural infestation of isolated, commercial colonies placed in locations containing feral colonies, the results of which are reported here.

In spring 2005, all adult SHB were individually collected at a commercial apiary (near Berowra, NSW, Australia) from 12 reasonably strong (3-5 frames of brood, 6-8 frames of bees), queenright honey bee colonies of mixed European origin (predominantly *A. m. ligustica*) housed in standard Langstroth hives, via thorough visual surveys using aspirators (Neumann and Hoffmann, 2008) and brought to the laboratory for quantification. During the surveys, all colony phenotypes were evaluated using the Liebefelder standard (areas with bees, open and capped brood, honey, pollen). Immediately after the survey, the colonies were transported to two isolated woodland apiary sites in NSW, more than 15 km away from any other managed colonies (Blue Mountains National Park), but in areas known to contain feral honey bees. Five days later, all colonies were again surveyed in the same fashion.

The numbers of live adult SHB per colony are shown in Table 1. At both apiaries, one colony had absconded after five days. In both cases, SHB mass reproduction (>1000 larvae) had resulted in the full structural collapse of the entire nest, strongly suggesting that the

colonies absconded due to SHB infestation. Before transport, the colonies had a mean infestation of 38.58 ± 26.55 , which was significantly lower than that recorded in the second survey, following their relocation (326.5 ± 197.42 , $N = 10$ colonies; Mann-Whitney U Test Statistic = 92.00, $p < 0.001$). As with earlier reports (Neumann and Elzen, 2004), infestation levels were highly skewed at both apiaries, ranging from 30 to 665 SHB per colony in the second survey, and were not correlated with estimated areas of bees, open and capped brood, honey or pollen in the colonies prior to relocation (Spearman rank correlations, $p > 0.10$ in all cases, data not shown). Assuming that free-flying adult SHB are attracted to volatile cues (c.f. Neumann

Table 1. Number of live adult SHB per colony detected during visual inspections before (first survey), and five days after transport (second survey) to two isolated woodland apiaries. * = these hives had absconded and large numbers of SHB larvae were found in the hive.

	Colony	First survey	Second survey
Apiary 1	1	9	321
	2	17	420
	3	37	48
	4	29	30
	5	93	323
	6	32	*
Apiary 2	1	8	344
	2	53	321
	3	25	665
	4	83	542
	5	36	251
	6	41	*
	Total	463	3265

and Elzen, 2004), it appears that the unnatural high density of host colonies, and thus odour cues, at a commercial apiary may mask the potential attractiveness of specific hives. Therefore, individual SHB factors, e.g. first hive infested by chance alone and subsequent attraction of SHB to each other, rather than phenotypic characteristics seem to govern the attractiveness of specific host colonies to adult SHB, at least at an apiary level.

Since SHB reproduction on alternative food sources appears to be minor (Buchholz *et al.*, 2008), the high numbers of adult beetles collected after five days strongly suggest considerable infestation levels of feral honey bee colonies, thereby supporting earlier reports (Gillespie *et al.*, 2003; Annand, 2007). Our data further propose that feral colonies can be substantial refuges from which to infest managed colonies. Indeed, an average of 65 new SHB infested each colony daily. Moreover, SHB infestation levels were significantly higher during the second survey in the woodland without apiaries, although the colonies originated from a coastal area with beekeeping. In conclusion, our data suggest considerable difficulties for SHB pest control in Australia and other areas with feral or wild honey bees, such as Asia or South America.

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